To know that which before us lies in daily life is the prime wisdom.—Milton.

Honolulu Star-Bulletin

Nothing can bring you peace but yourself. Nothing can bring you peace but the triumph of principles.—Emerson.

HONOLULU, TERRITORY OF HAWAII, SATURDAY, JANUARY 6, 1917.

TWENTY-THREE

NEWS AND PRACTICAL INFORMATION ABOUT AUTOMOBILES

INDUCTION COILS DISCUSSED BY TECHNICAL EXPERTS IN LESSON ON ELECTRICAL EQUIPMENT OF THE AUTOMOBILE

(By Special Permission from Motor Age.)

From the previous discussion it is seen that the direction of the induced pressure depends upon the direction of the magnetic field and the direction in which the conductor is moved with respect to the magnetic field. If a metal rod be bent into the form shown by A, B, C, D, Figure 1, and a second rod, E F, be placed across the ends of the first rod and the combination placed in a magnetic field, as shown by the vertical arrows in the figure, there will be a current around the circuit thus formed when the conductor E F is moved to the right or to the left of the initial position. When the conductor E F is moved it cuts some of the lines of force of the magnetic field and there is an induced pressure produced in it which in turn produces the current. The direction of this current will be increased where the direction of the motion of E F, or the direction of the magnetic is reversed.

When the wire E F is moved to the right the end F is positive and the other end, E, is negative, or the electrical pressure induced in the wire tends to send a current around the circuit from F through B and C to E. The wire E F is the part of the circuit in which the pressure is generated, and the electricity will flow from a point of one pressure to a point of higher pressure just as in the case of the battery.

Determining Direction of Pressure

A simple way of determining the direction of the induced pressure when the direction of motion of the wire and the magnetic field is known is as follows: Suppose a wire, Figure 2, is moved toward the right, as indicated by the horizontal arrow B, in a magnetic field where direction is downward, as shown by the small arrow heads at the bottom of the figure. The lines of force might be thought of as elastic bands that are pushed aside when the wire is moved in the magnetic field, but finally break and join on the left side of the wire, leaving a line linked around the conductor, as shown by the circles C and D. The direction of these lines of force about the conductor is clockwise, and they correspond to lines produced by a current toward the paper, or away from the observer. Hence the direction of the induced electrical pressure is toward the paper. It must be remembered that the electricity travels up hill electrically in this part of the current, just as it does in the case of a cell.

One of the best rules for remembering the relations between the direction of the magnetic field, the direction in which the wire moves and the direction of the induced electrical pressure, is known as Fleming's Right Hand Rule, and it is as follows: Place the thumb and first and second fingers of the right hand all at right angles to each other. Now turn the hand into such a position that the thumb points in the direction of the motion of the wire and the first finger points in the direction of the magnetic field, then the second, or middle finger, will point in the direction of the induced pressure.

If a coil of wire, S, be connected in series with a galvanometer, as shown in Figure 3, and a second coil, P, that has the winding connected to a battery be moved into or out of the coil S, there will be a deflection of the galvanometer, just as if a permanent magnet had been used instead of the coil P. The coil S, in which the induced pressure is produced, is called the secondary and the coil P, in which the inducing current exists, is called the primary.

There are a number of different ways of producing an induced pressure in the secondary coil besides moving the primary coil with respect to the secondary coil. Four of these methods are as follows (both coils are stationary and one surrounds the other or they are both wound on the same magnetic circuit):

(a) By making or breaking the primary circuit. Imagine two wires A B and C D, Figure 4, that are parallel to each other and very near together, but connected in two electrically independent circuits. The wire A B is in series with the galvanometer, G, and constitutes the secondary circuit. The wire C D is in series with a battery, E, and a switch, K, which may be used in opening and closing the primary circuit. When the primary circuit is completed by closing the switch K there will be a current through the wire C D from C toward D. This circuit will produce a magnetic field about the wire C D, and the lines of force of this magnetic field will cut the wire A B, which will result in an induced pressure being produced in the wire A B and causing a current from T toward B.

Right Hand Rule

The direction of the induced pressure can be determined by means of the Right Hand Rule. There will be an induced pressure produced in the wire A B for a period of time corresponding to the time required to establish the current in the primary. As soon as the current in the primary becomes steady there will be no movement of the magnetic field and the conductor A B with respect to each other. When the current in the wire C D is increasing in value the magnetic field surrounding the wire is expanding and moving outward across the conductor A B.

If, now, the primary circuit be broken the magnetic field surrounding the wire C D will collapse, and as a result the wire A B will cut the magnetic field again, but in the opposite direction to that when the circuit in wire C D was being established. There will be a current produced in the secondary circuit that is practically constant in duration if the primary circuit is made and broken a sufficient number of times. The current produced in the secondary circuit is called an alternating current, because it alternates in direction, it being in one direction when the current in the primary is increasing in value and in the opposite direction when the current in the primary is decreasing in value.

The wires forming the primary and secondary circuits are usually wound into coils, and they may be placed side by side or one outside the other. The pressure induced in the secondary, due to a given change of current in the primary, in a certain time can be greatly increased by placing the two windings on an iron core. The magnetic field that passes through the two windings due to the current in the primary is a great deal stronger when they are placed on the iron core than it is when an air core is used, and as a result a greater number of lines of force will cut the secondary winding when the primary circuit is completed or broken.

Induction Coil

The induction coil consists of two windings, a primary and a secondary placed upon an iron core with a suitable device connected to the primary circuit for interrupting the primary current. The relation between the pressure acting on the primary winding and the induced pressure produced in the secondary winding is practically the same as the relation between the number of turns of wire in the primary and secondary windings.

This is the method used in the simplest battery and coil ignition system, as illustrated in Figure 5. The spark plug in Figure 5 replaces the galvanometer in Figure 4 and the interrupter, or circuit breaker, replaces the switch K. The interrupter simply is an automatic switch which rapidly opens and closes the circuit. The wire between A and G in Figure 4 is replaced in the ignition system by the metal of the engine between the spark plug and the coil terminal, as shown in Figure 5.

(b) Varying the strength of the current in the primary: This in reality is practically the same as the previous method, except the primary circuit is not entirely opened. Any change in the value of the primary current will result in a change in the magnetic field surrounding the primary winding, and as this field expands or contracts it will cut the wire composing the secondary circuit, and as a result there will be an induced pressure set up in the secondary winding. The direction of this induced pressure will depend upon whether the field is expanding or contracting, which, in turn, depends upon the change of current in the primary winding—whether it be increasing or decreasing.

(c) Reversing the current in the primary: If a switch were constructed so that its operation would reverse the current in the primary winding of an induction coil at regular intervals there would be an induced pressure produced in the secondary winding, due to a change in the strength of the magnetic field through the two windings. This method is applied in practise in what is called the transformer. The switch, however, is not used, as the current in the primary winding is an alternating current—a current that is reversing in direction at regular intervals.

(d) Moving a portion of the magnetic circuit, about which the windings are placed: The magnetic field produced by a given value of current in the primary winding of an induction coil will depend upon the kind of material composing the magnetic circuit, whether it is a material of low or high permeability. If a core upon which the windings are placed or a part of the magnetic circuit be moved so as to change the resistance of the magnetic circuit there will be a change in the number of lines of force through the windings, and as a result there will be an induced electrical pressure produced in the windings. If the resistance of the magnetic circuit be increased, there will be a decrease in the number of lines of force, and if the resistance be decreased there will be an increase in the number of lines of force, all other things remaining unchanged. When the lines of force through the windings decrease there will be an induced pressure set up in the windings in the opposite direction to that set up when the magnetic lines of force increase. This principle is employed in what are called the inductor types of magnetos.

Mutual Induction

The reaction of two independent electrical circuits upon each other is called mutual induction. These circuits must be so placed with respect to each other that the magnetic field, due to the current in either of them, will produce an effect in the other. The induction coil or ignition spark coil, is a fine example of the practical application of mutual induction.

If the value of the current in a wire be changed in any way there will be a change in the strength of the magnetic field surrounding the wire. This change in the strength of the magnetic field will produce an induced pressure in the wire in which the current is changing in value just as if the magnetic field were changed in strength by a current in an independent electrical circuit. This property of a circuit which results in an electrical pressure being produced in the circuit when there is a change in the value of the current in the circuit is called the self-inductance of the circuit.

When a coil carrying a current has its circuit broken there will be a spark formed at the break due to the induced pressure. The value of this induced pressure depends upon the form of the coil and the kind of material associated with the coil. A straight wire will have a small pressure induced in it when the circuit is broken, as the magnetic field surrounding the wire is not very strong. If the wire be bent into a coil the induced pressure will be greater than that for the straight wire, as very nearly all the magentic lines of force produced by each turn of the coil cut all the other turns of the coil and the total number of lines of force cut by the wire forming the coil is greatly increased. This induced pressure can be increased further by providing the coil with an iron core, which increases the field strength caused by any given current in the winding.

In make and break ignition it is desirable to have a hot spark at the point where the circuit is broken inside the cylinder, and for this reason a coil having a rather high self-inductance is usually connected in series, which results in a large arc, or spark, being forward when the circuit is broken.

Unit of Inductance

A circuit is said to have a half-inductance of one henry when there is an electrical pressure of one volt induced in the circuit due to a change in the value of the current in the circuit of one ampere in one second. That is, if the current changes, say, from two to three amperes in one second and there is an induced pressure of one volt, the current is said to have a self-inductance of one henry.

The mutual inductance between two circuits is measured in the same unit as the self-inductance of a single circuit. If the current in one circuit changes at the rate of one ampere a second, and as a result of this change there is an induced pressure of one volt produced in a second circuit, the two circuits are said to have a mutual inductance of one henry.

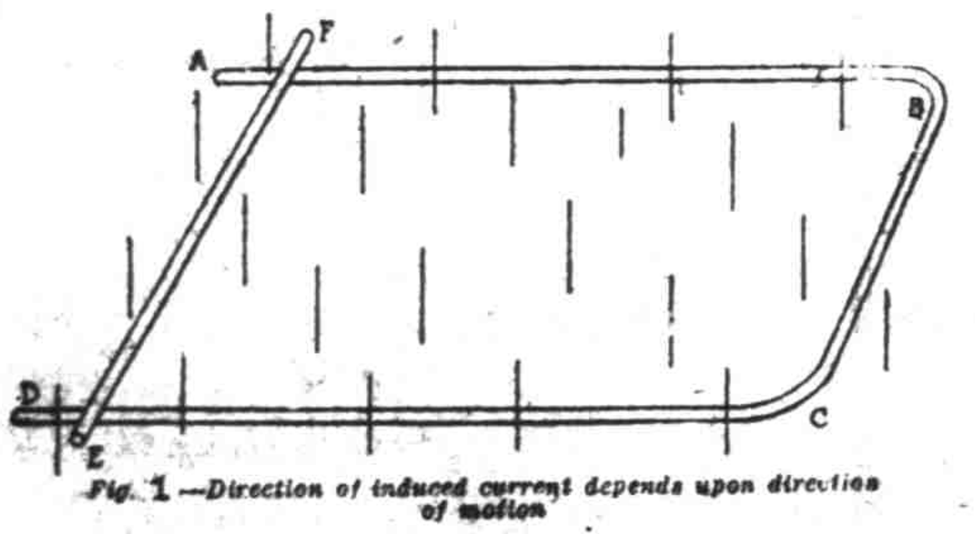

Fig. 1—Direction of induced current depends upon direction of motion

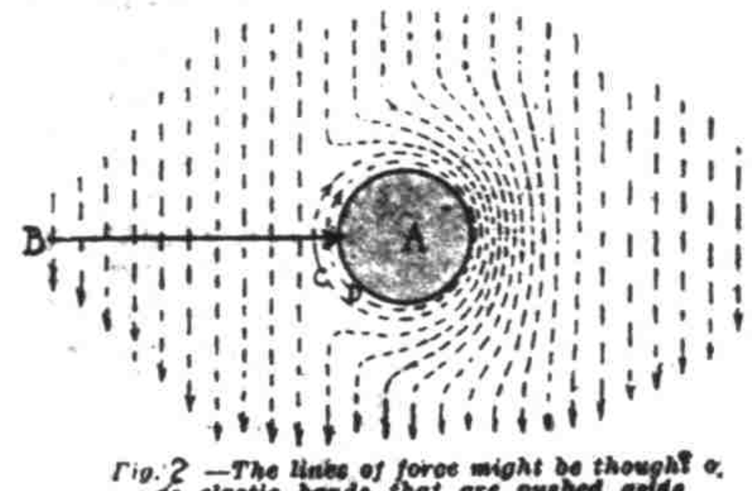

Fig. 2—The lines of force might be thought of as elastic bands that are pushed aside when the wire is moved, then break and join on the other side

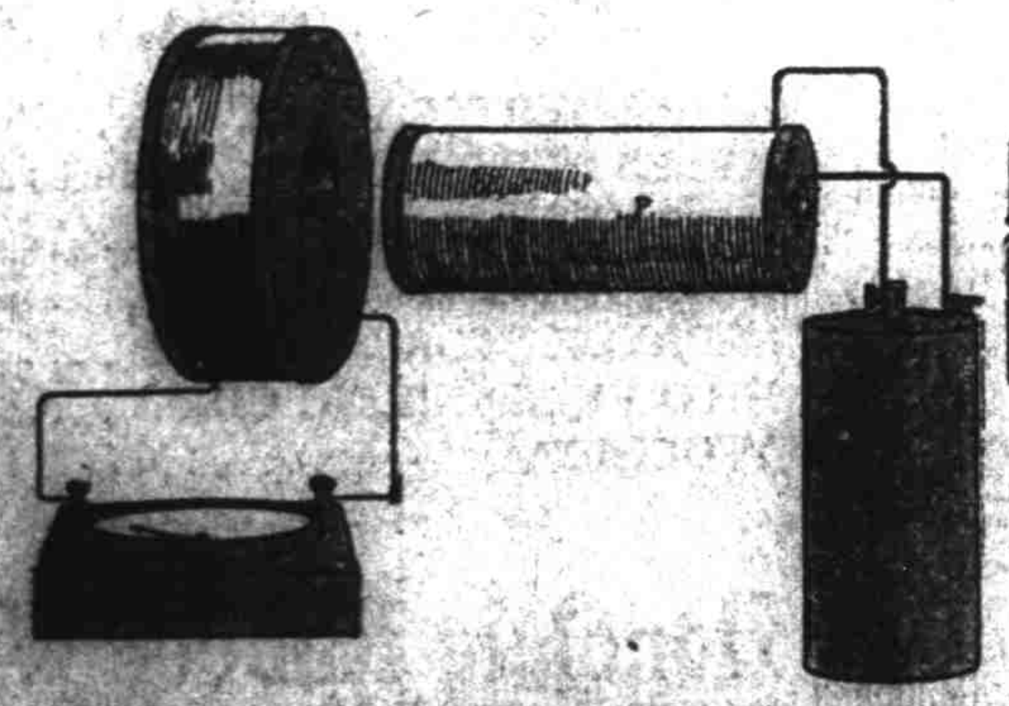

Fig. 3—The coil S, in which the induced pressure is produced, is the secondary, and the coil P, in which the inducing current exists, is the primary coil

COURTESY MOTOR AGE.

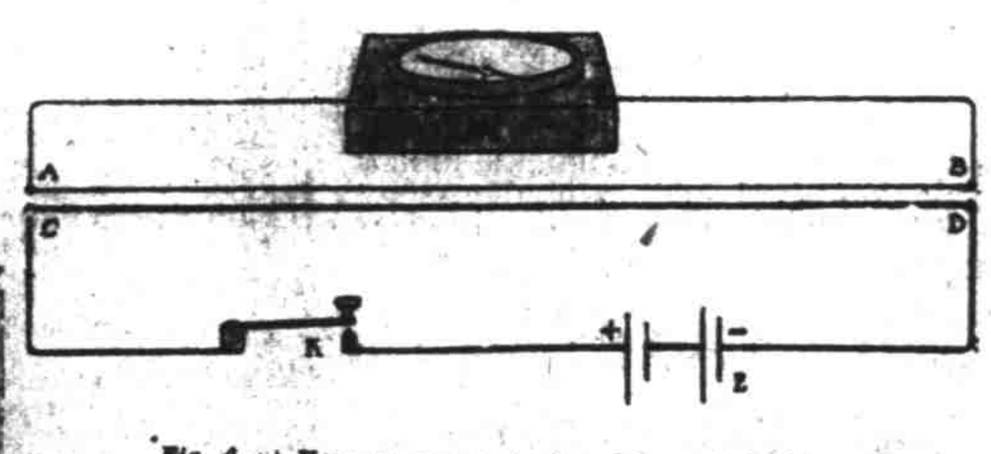

Fig. 4—How current is produced in an induction coil

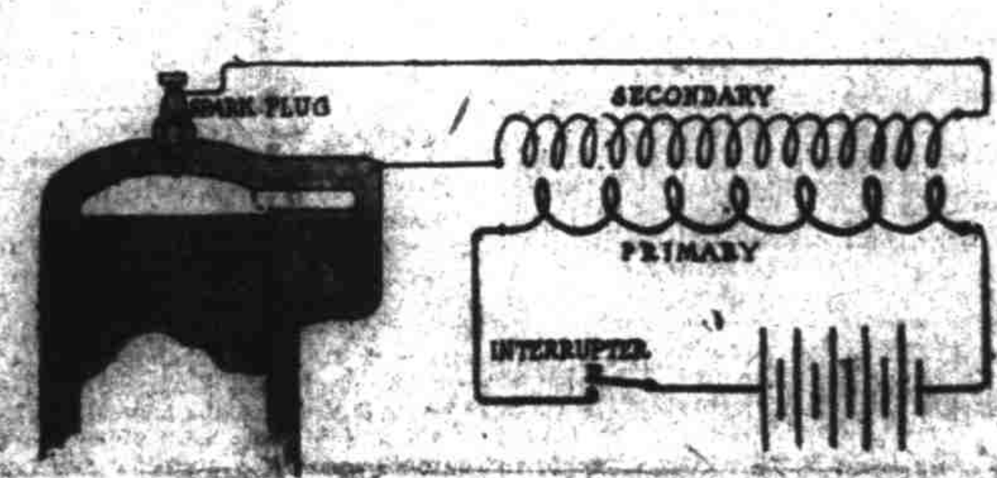

Fig. 5—How the induction coil is applied to the ignition of a motor car engine

SETS TRANSCONTINENTAL RECORD

MULFORD AT WHEEL OF HUDSON WHICH SET TRANSCONTINENTAL RECORD

The photograph reproduced above shows the Hudson "super-six" which last week set a new transcontinental record by making the trip from San Francisco to New York city in 5 days 3 hours and 31 minutes. At the wheel is Ralph Mulford, who alternated with two other drivers in bringing the automobile through to its record.

JOHNNY AITKEN OWES MUCH OF FAME TO TIRES

Speedway King Has Good Word to Say for Goodyear Cord Tires; Always Uses Them

Johnny Aitken, the speedway champion, who has won so consistently on the speedways of the country the past season, first began to coax speed from racing cars back in 1904. Since then his career has been sensational.

"In all my speedway experiences with Goodyear Cord tires on either brick or board courses," said Aitken, when asked about his experience with tires, "I've found them ready to finish if I was. I never had one flunk out on me when I needed it. This sort of stuff in a tire means something to a racing driver. Where a win is a matter of seconds, first position may hang on whether you limp to the pit or roll up. I always roll up on Goodyear Cords.

"Naturally, I don't drive a hundred-and-five or better—all of the time. The traffic policemen have their own ideas in the matter of sane speeds, as have I. But I do drive Goodyear Cords all the time. Off the race track I get about in a Sedan which wears them."

Aitken's first notable victory on Goodyear Cords occurred at the dedication of the new Cincinnati speedway on Labor Day, where he won the 300-mile sweepstakes over a field of 28 starters, averaging 97.06 miles per hour.

At Sheepshead Bay, on Sept. 30, he won the 250-mile Astor Cup race, and broke the world's speed record for that distance, averaging 104 2-3 miles per hour. Aitken drove the entire race without a stop.

On the same track he captured the 100-mile Harkness Gold Trophy race, on Oct. 28, and established a new American record of 105.85 miles per hour, clipping 30 seconds from the best previous record. Expert timers several times detected his car making intermediate miles at the rate of 110 miles an hour.

At Santa Monica, Cal., he added to his already numerous laurels by winning the 403¼-mile road race, averaging 85.59 miles per hour—ten miles per hour faster than the best previous time.

Aitken's racing experience, as well as that of the other drivers who have used Goodyear Cords, has served to bring out the qualities that lead to their adoption on such cars as Franklin, Packard, Locomobile, Peerless, White, Haynes, Stutz, McFarlan, Roamer and Daniels.

LOCAL FIRM HAS 'SERVICE' MOTTO

In this day of keen competition in the automobile and allied industries, and in most any line of business as well, the progressive businessman is constantly on the lookout for ways and means to make his business a little bit better. In this natural evolution one particular feature has been brought out and played up, and has become a very important feature in every line of business; it is "service."

The Honolulu Rubber Works, Ltd., formerly the Kershner Vulvanizing Company, Ltd., has made service one of the foundation stones of its business, and has always been on the lookout for ways and means to improve the efficiency of its service, believing that the public appreciates service. That this opinion is correct is clearly shown in the large volume of business which this firm has developed and which is increasing from month to month.

"We have always contended that when we sell a federal tire, our responsibility begins and it is up to our service department to watch the results on this sale and see that the tire makes good in every way," said Mr. R. M. Talbott, manager of the company.

TRUCK TIRE CONCERN BASES SUCCESS CLAIMS ON PRODUCT'S QUALITY

The service that a motor truck renders is dependent not only upon the motor and driver, but the tires with which it is equipped, as well. Quality in tires relieves the driver of tasks for which he is often unfitted and which more often sacrifices hours of his time at an expense that makes the truck more costly and more unsatisfactory than the horse.

The makers of Gibney motor tires base their claims to success in the business upon the quality that is put in their product. This quality magnifies the radius of travel, as it conserves the value of the truck itself and makes every hour of the driver's time available for profitable delivery. It is the quality first principle with the factory that guarantees its output. It is claimed for the Gibney tire that it is a "little better than the best" and this reputation is founded upon a world wide search for materials, methods and men to create improvement of tire, of method, and of production.

RUBBER TREES PRODUCE FIVE POUNDS EACH YEAR

A rubber tree in full maturity produces from three to five pounds of rubber a year. Usually about 100 trees are planted to the acre. Time was when Brazil was the crude rubber center of the world, but today the plantations of the Far East are producing four times as much rubber as the forests of the Amazon.

RISE OF YOUNG MAN FROM RANKS IN AUTO FIELD

"Cliff" Durant Was Given Job in Carriage Works; Youngster Started at Bottom

The story of how W. C. Durant trained his son, R. C. Durant, for the place he now holds as vice-president of the Chevrolet factory on the Pacific coast; and of how, with President Norman Vaux, the younger Durant built up the great organization on the Pacific coast in two years, is an interesting story.

When he was 10 years of age "Cliff" Durant was put to work by his father. Before and after school hours he painted bolt heads at 10 cents per hour in the old Durant-Dort Carriage Works. He was kept at this until he was 12; then he painted springs.

During Durant's first year at high school his father started him in the automobile industry. After school hours and for an hour every morning he worked in the factory. He started in at the bottom. Threading bolts and tapping nuts was his job and there was a stern foreman over him to see that he did his work well.

While attending the Detroit university school he worked during his vacations. He then went to the University of Michigan. The climate at Ann Arbor did not agree with "Cliff" or else he knew a lot of things that the faculty could not find out. He showed up at Flint a full fledged member of the "Premature Alumni," that organization which rivals Phi Beta Kappa. His father put him in overalls and made him carry a dinner pail and punch the time clock like all the rest of the boys in the factory.

Goes on the Road as Tester

After a time he became a road tester and it was driving over the rough Michigan roads that gave him his first lessons in road driving which made him thousands of dollars later on. From road tester "Cliff" was sent out as a traveling mechanic, a service man on the road for the company. He was then called back to the factory and put to testing motors. He then went into the experimental department.

The next step in the education of the young man was into the sales end of the industry. His father sent him down to Atlanta, Ga., where he was put to work as a retail salesman. Soon he became retail sales manager for the dealer there.

The wholesale department was his next course and it was while he was representing the Chevrolet factory in the New York territory that he was called into the factory, whence he was ordered to the Pacific coast.

CADILLAC EIGHT CLIMBS DIABLO ON HIGH GEAR

Carrying four passengers, a photographer's outfit, a spare tire and with all tanks practically full, a Cadillac Eight recently climbed Mount Diablo, in California, on high gear, thus establishing a record.

The climb is 19 miles long and the Cadillac is the first motor car ever to make it on high gear when carrying more than one passenger. The total weight of the passengers was 786 pounds. Reports from San Francisco say the car negotiated the climb with such ease that it is believed it could have carried its capacity of seven persons. Motoring circles in the California metropolis regard it as a hard demonstration for a car to climb Mt. Diablo on high with only one passenger. At all times during its ascent the Cadillac had reserve power, never being pressed to make the grade.

GASOLINE MUCH CHEAPER THAN OATS, SAYS EXPERT

"The average well kept horse consumes a quart of oats for each of the eight or twelve miles per day that it is able to travel," says H. S. Daniels of the KisselKar.

"A motor truck big enough — or small enough—to haul the same load consumes a gallon of gasoline to each 15 or 16 miles that it travels.

"Therein lie the basic facts whereby statisticians may figure the relative expense of horse power engendered by grain and oil, respectively. The result will emphasize one of the many reasons why nearly all business houses will eventually motorize their delivery departments."

If the performance of Goodyear Cord tires in the Astor Cup race at Sheepshead Bay is to be taken as a criterion, it would seem that tire changes in the [illegible] are soon to become a thing of the past. First and second in this race were won on Goodyears without a stop.